

## SECTION VII. MAINTENANCE OF RUBBER HOSE ASSEMBLY BRACKET GROUP AND POWER AND EQUILIBRATOR CYLINDER ASSEMBLIES

### 95. General

This section covers the maintenance of a typical power or equilibrator cylinder assembly and a rubber hose assembly bracket group. The general precautions in paragraph 58 must be observed when any hydraulic system maintenance is performed.

### 96. Hose Assembly Bracket Group

#### a. Removal.

*Note.* Place a suitable container under the cylinder assembly (25, fig. 209) being removed, to catch the hydraulic fluid.

- (1) Open the EQUILIBRATOR SYSTEM BY-PASS valve (fig. 60) and the SYSTEM BY-PASS valve.
- (2) Depressurize the hydraulic oil reservoir by turning the handle of the plug cock to the VENT position and holding until all pressure is discharged.
- (3) Remove the launcher rack assembly as described in paragraph 61a(1) and (2).
- (4) Remove the U-bolts (3, fig. 209).
- (5) Disconnect the tube assemblies (4, 5, 6, and 7).
- (6) Disconnect the hose assemblies (8).
- (7) Remove the bracket group (9).
- (8) Cap all open tube assemblies and hose assemblies to prevent the entry of foreign material.

b. *Disassembly.* Disassemble the bracket group (fig. 210) as required.

#### c. (Deleted)

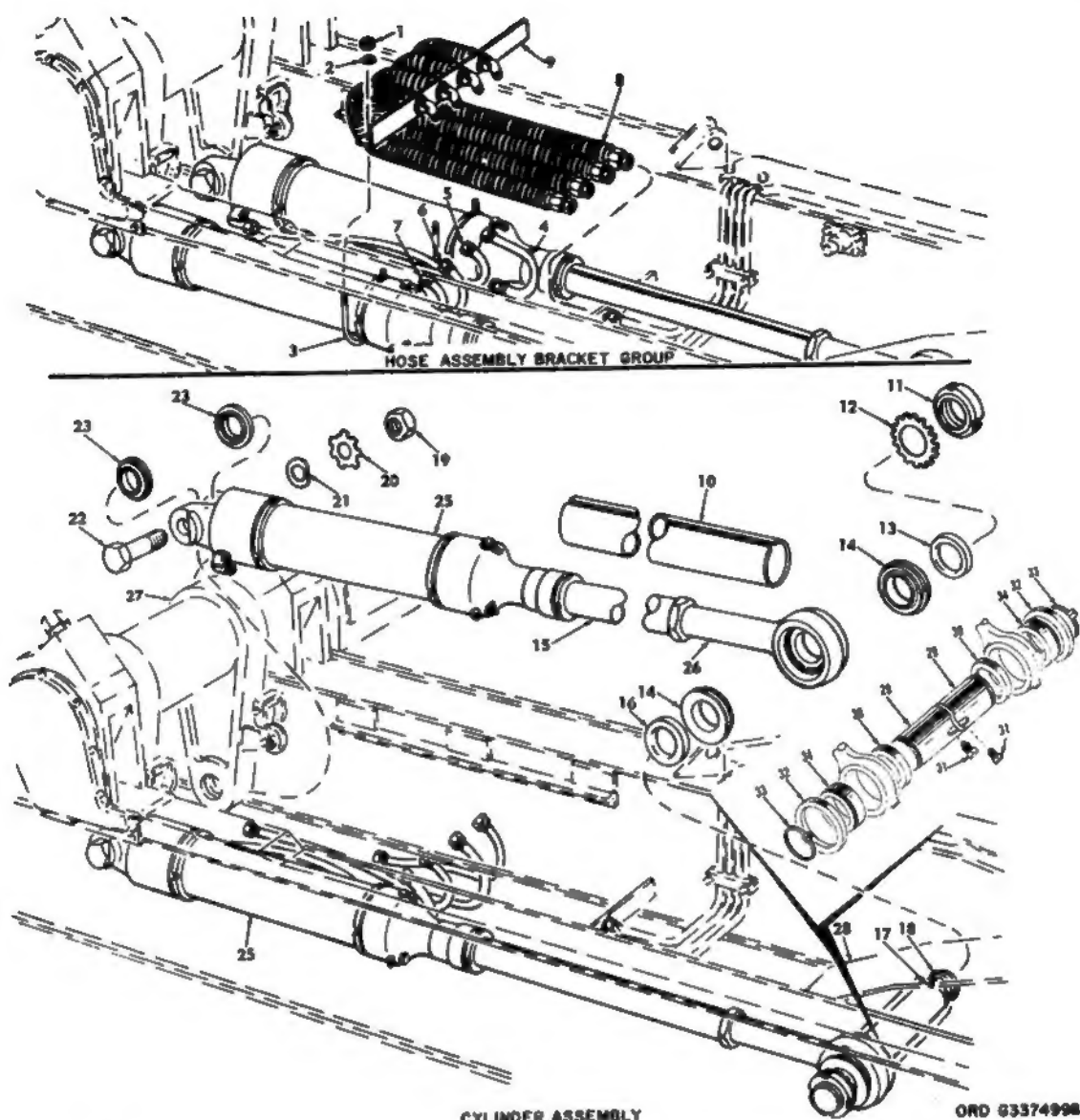
d. *Installation.* At least two men are required to accomplish this procedure. An additional rubber hose assembly (1 of step A, fig. 210.1) and a union (2 of step A) are used to assemble and install the hose assembly bracket group (fig. 210). Obtain these two parts before

proceeding with (1) below.

- (1) Join the two rubber hose assemblies (1 and 3 of step A, fig. 210.1) together using a union (2 of step A).
- (1.1) Slide the hose assemblies (1 and 3 of step B) through a metal hose (4 of step B).
- (1.2) Connect the rubber hose assembly (3 of step B) on the nipple (step B) of the launcher and torque to 500 pound-inches.

*Note.* The metal hose (1 of step A, fig. 210.2) is designed to be installed in the compressed condition. For ease of maintenance, an adjustable wrench, (step A) should be used to assist installation.

- (1.3) Compress the metal hose (1 of step A, fig. 210.2) far enough to expose the rubber hose assembly (2 of step A).
- (1.4) Adjust the wrench (step A) to the outside diameter of the rubber hose assembly.
- (1.5) Insert the wrench over the rubber hose assembly and release the compression of the metal hose.
- (1.6) Disconnect the hose assembly (3 of step B) and remove the nipple (4 of step B).
- (1.7) Install the tube elbow (1, fig. 210.3) on the bracket (2) and connect the rubber hose assembly (5).
- (1.8) Torque the connection to 500 pound-inches and remove the adjustable wrench (7).
- (1.9) Install each of the three remaining hose assemblies (3 of step A, fig. 210.1) as described in (1) through (1.8) above.
- (1.10) Install the hose assembly bracket group (9, fig. 209) and secure with the U-bolts (3), lockwashers (2), and hexagon nuts (1).
- (2) (Deleted)



- 1-1/4-20 hex. nut
- 2-1/4 in-id lk washer
- 3-1/4-20 U-bolt
- 4-Tube assy 8167923
- 5-Tube assy 8167921
- 6-Tube assy 8167920
- 7-Tube assy 8167922
- 8-Rubber hose assy (p/o hose assy bracket group)
- 9-Hose assy bracket group
- 10-Protective cover
- 11-2.933-12NS-3 rd nut
- 12-3-in-id ext-teeth lk washer
- 13-Spacer 9019312
- 14-Spacer assy 11067588
- 15-Rod assy
- 16-Spacer 9019312 (used on launchers 1021 through 3684 and 50000 through 50087)
- 17-1/2-13 x 9/16 setscrew
- 18-Trunnion pin

- 19-1 3/4-12 hex. nut
- 20-1 3/4-in. id key washer
- 21-1 13/16 in-id fl washer
- 22-1 3/4-12 x 5 9/16 shoulder bolt
- 23-Spacer assy 11067557
- 24-(Deleted)
- 25-Power cylinder assy 8167733 or equilibrator cylinder assy 8522297
- 26-Eyebolt (p/o power or equilibrator cylinder assy)
- 27-Trunnion support arm
- 28-Strut assembly
- 29-Pivot rod 8031527
- 30-Spacer 8031526 (used on launchers 1021 through 3684 and 50000 through 50087)
- 31-Setcrew 8031523
- 32-Retainer washer 8031524
- 33-External retaining ring MS 16624-1300
- 34-Bearing assembly 8031530

Figure 209. Typical removal and installation of the hose assembly bracket group and power or equilibrator cylinder assembly.

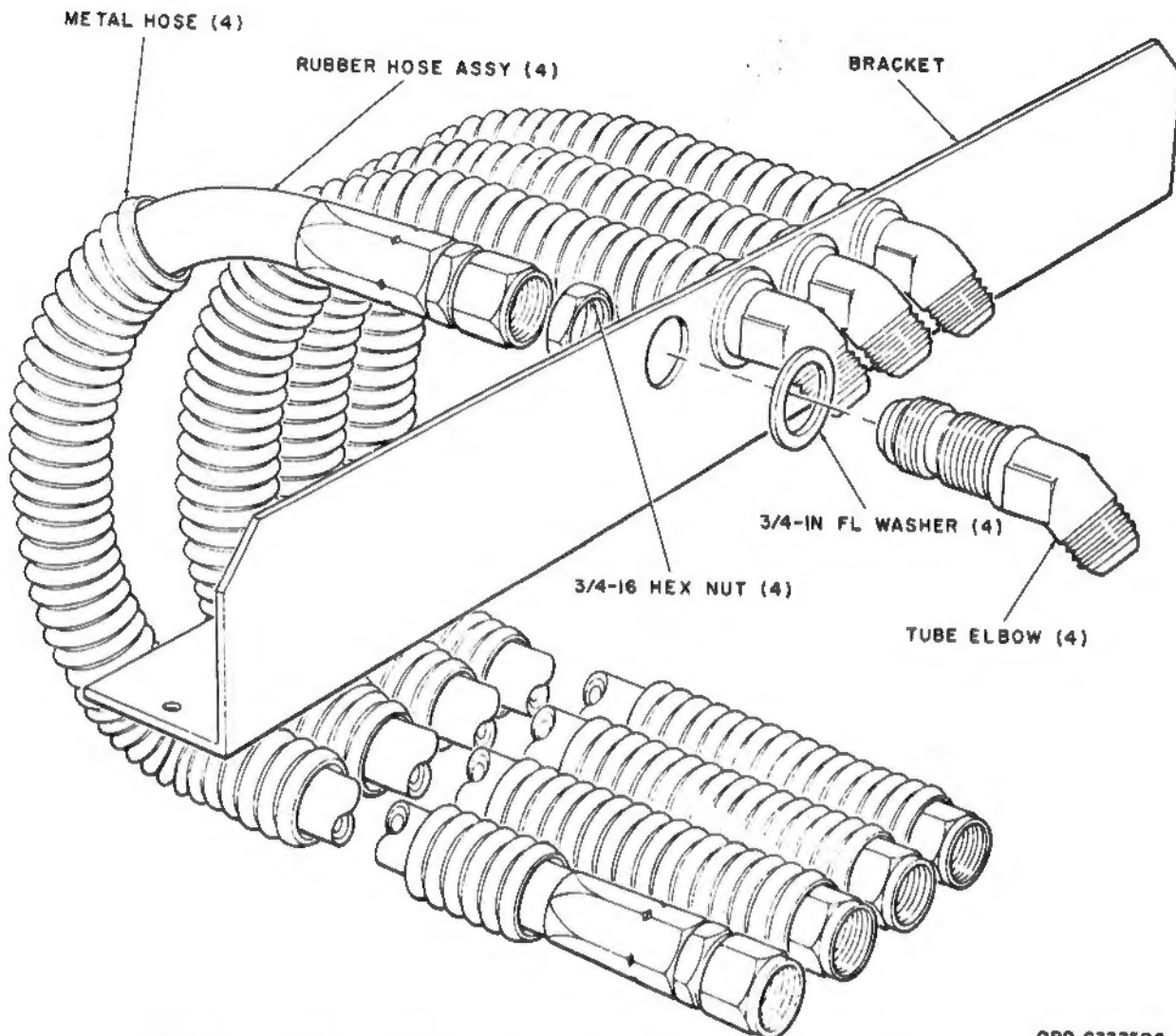


Figure 210. Hose assembly bracket group—assembly and partial installation—typical.

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- (3) Install the launcher rack assembly as described in paragraph 61b (5) and (6).
- (4) Close the EQUILIBRATOR SYSTEM BY-PASS valve (fig. 60) and the SYSTEM BY-PASS valve.
- (5) Pressurize the hydraulic oil reservoir by turning the handle of the plug cock to the AIR position.
- (6) Perform the launcher hydraulic sys-

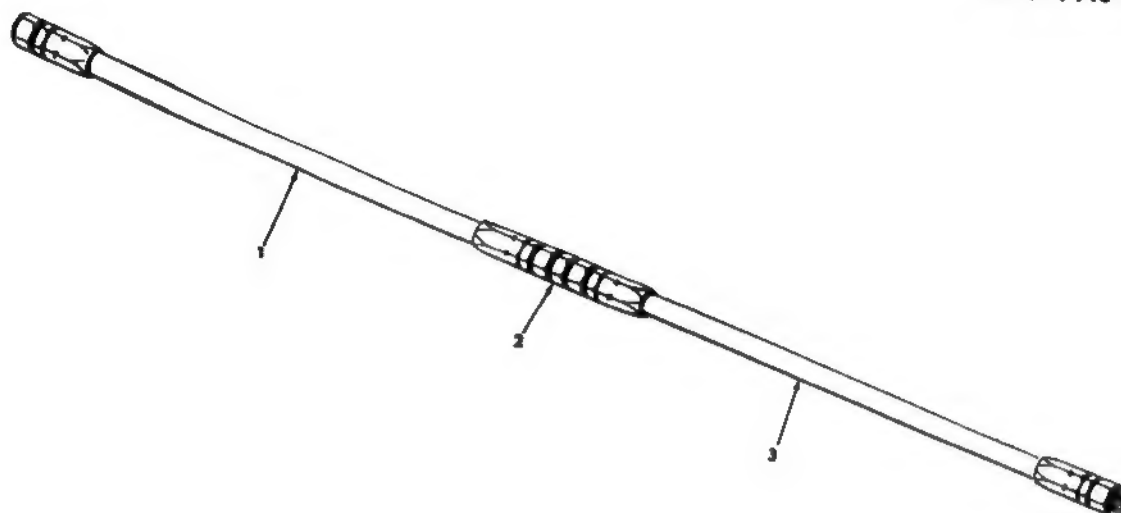
tem air bleed procedure as outlined in TM 9-1440-250-20/1.

## 97. Power or Equilibrator Cylinder Assembly

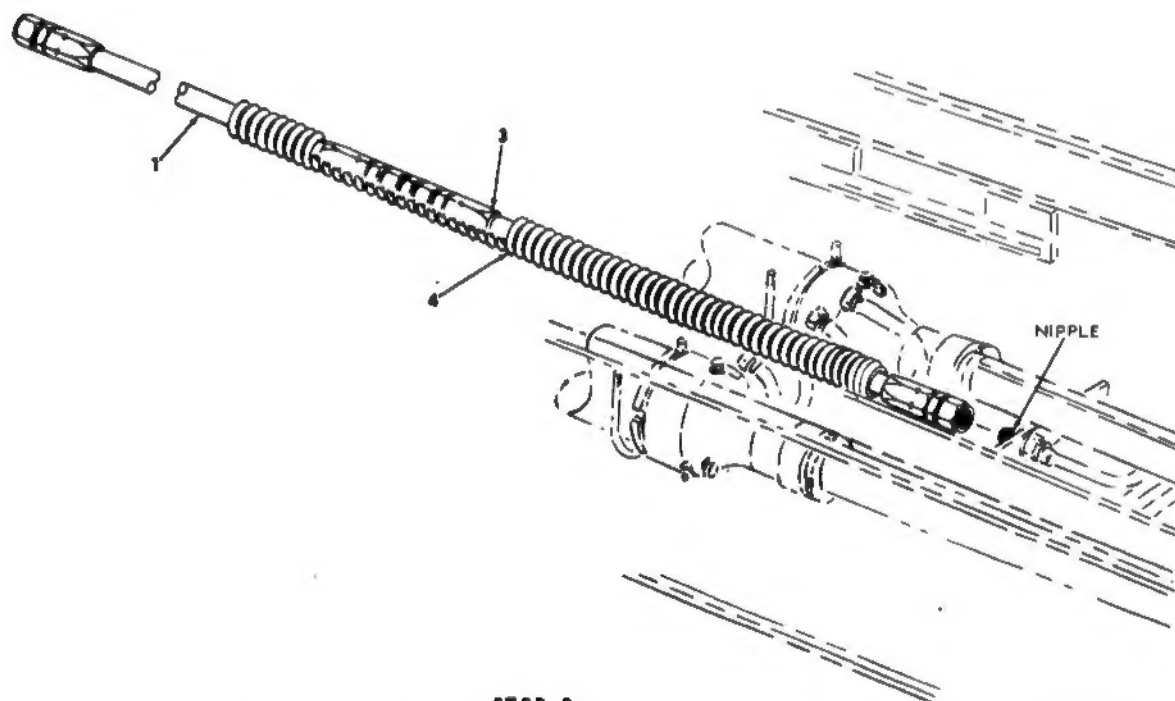
### a. Removal.

- (1) Remove the hose assembly bracket group (9, fig. 209) as outlined in paragraph 96a.

*Note.* If repair kit 5952278 has not been installed, perform steps (2) and (3) below.



STEP A



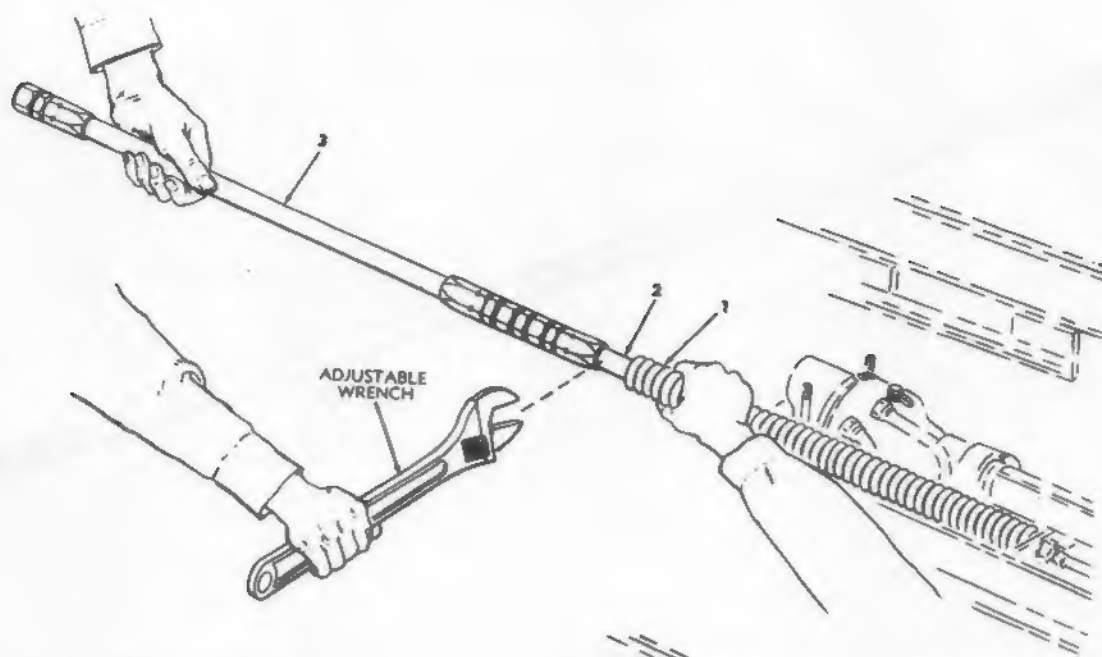
STEP B

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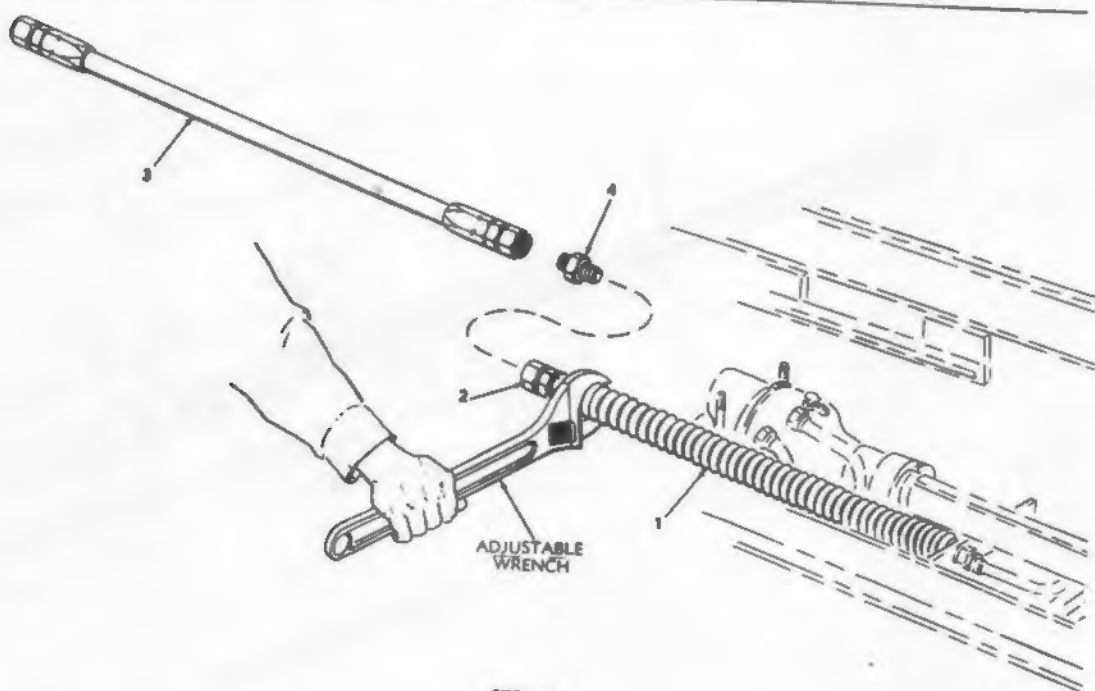
- 1—Rubber hose assembly MS28759H42 (used only during installation procedure)
- 2—Union (used only during installation procedure)

- 3—Rubber hose assembly MS28759H42(4)
- 4—Metal hose (4)

Figure 210.1. Hose assembly bracket group—assembly and partial installation—typical.



STEP A



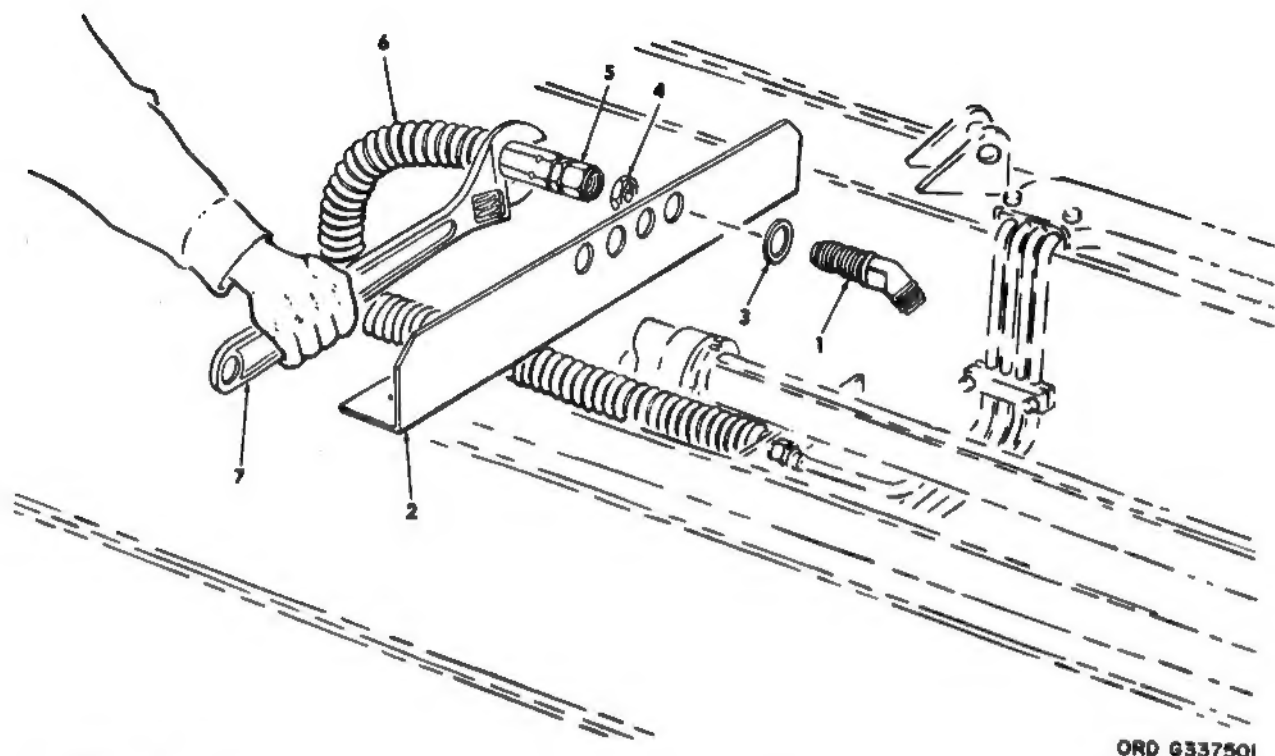
STEP B

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- 1—Metal hose (4)
- 2—Rubber hose assembly MS28759H42
- 3—Rubber hose assembly MS28759H42  
(used only during installation procedure)

- 4—Union (used only during installation procedure)

Figure 210.2. Hose assembly bracket group—assembly and partial installation—typical—continued.



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- 1 — Tube elbow (4)
- 2 — Bracket
- 3 —  $\frac{3}{4}$ -in. fl washer (4)
- 4 —  $\frac{3}{4}$ -16 hex. nut (4)

- 5 — Rubber hose assy (4)
- 6 — Metal hose
- 7 — Adjustable wrench

Figure 210.3. Hose assembly bracket group — assembly and partial installation — typical — Continued.

- (2) Unlock the lockwasher (12). Remove the round nut, lockwasher, and spacer (11, 12, and 13).
- (3) Loosen the two setscrews (17) to free the trunnion pin (18); move the pin until the end is flush with the edge of the bearing hole in the eyebolt (26).

*Note.* If repair kit 5952278 has been installed, perform steps (4) and (5) below.

- (4) Remove retaining ring (33, fig. 209) and washer (32).
- (5) Loosen the two setscrews (31) to free the pivot rod (29); move the pivot rod until the end is flush with the edge of the bearing in the eyebolt.
- (6) Unlock the keywasher (20), and remove the hexagon nut, keywasher, flat washer and shoulder

bolt (19, 20, 21, and 22) securing the cylinder assembly to the trunnion support arm (27). Remove the protective cover (10) and push the rod (15) into the cylinder until the shortest possible configuration can be obtained. This will ease handling of the cylinder and will afford mechanical protection to the rod. Lift the cylinder assembly by the clevis end and remove the eyebolt end of the assembly from the trunnion pin (18) or from the pivot rod (29).

*Note.* If repair kit 5952278 has not been installed, perform step (7) below.

- (7) Remove the spacer assemblies (14) from the eyebolt.

- (8) For launchers with serial numbers 1021 through 3684 and 50000 through 50087, remove spacers (16) or (30).
- (9) Remove the spacer assemblies (23) from the trunnion support arm (27).
- (10) Remove the retainer rings and the bearing from the trunnion support arm (fig. 212.1).
- (11) Clean and inspect the bearing. Discard and replace the bearing if any sign of corrosion, wear or damage is evident.

#### b. Disassembly.

*Note.* Use the holding fixture (fig. 55.3) for holding the cylinder assembly during disassembly.

*Note.* If the sleeve cylinder (9, fig. 211) is to be replaced, retain the shipping container for packaging and returning the defective part

- (1) Remove the lock wire (1) back off the jam nut and rod end washer (2 and 3).

*Note.* If repair kit 5952278 has not been installed, perform step (2) below.

- (2) Remove and disassemble the eyebolt group (4) and inspect the bearing and retainer rings (4B and 4C). If any sign of corrosion, wear, or damage is evident, install repair kit 5952278.

*Note.* If repair kit 5952278 has been installed, perform step (3) below.

- (3) Remove the eyebolt group, but do not remove the bearing assembly (4E) unless replacement is necessary; inspect the cylindrical and spherical bearing surfaces. If any sign of corrosion, wear, or damage is evident, replace the bearing assembly (4E) using procedures in paragraph 97.1.
- (4) Remove the lock wire and cylinder retainer (5 and 6).

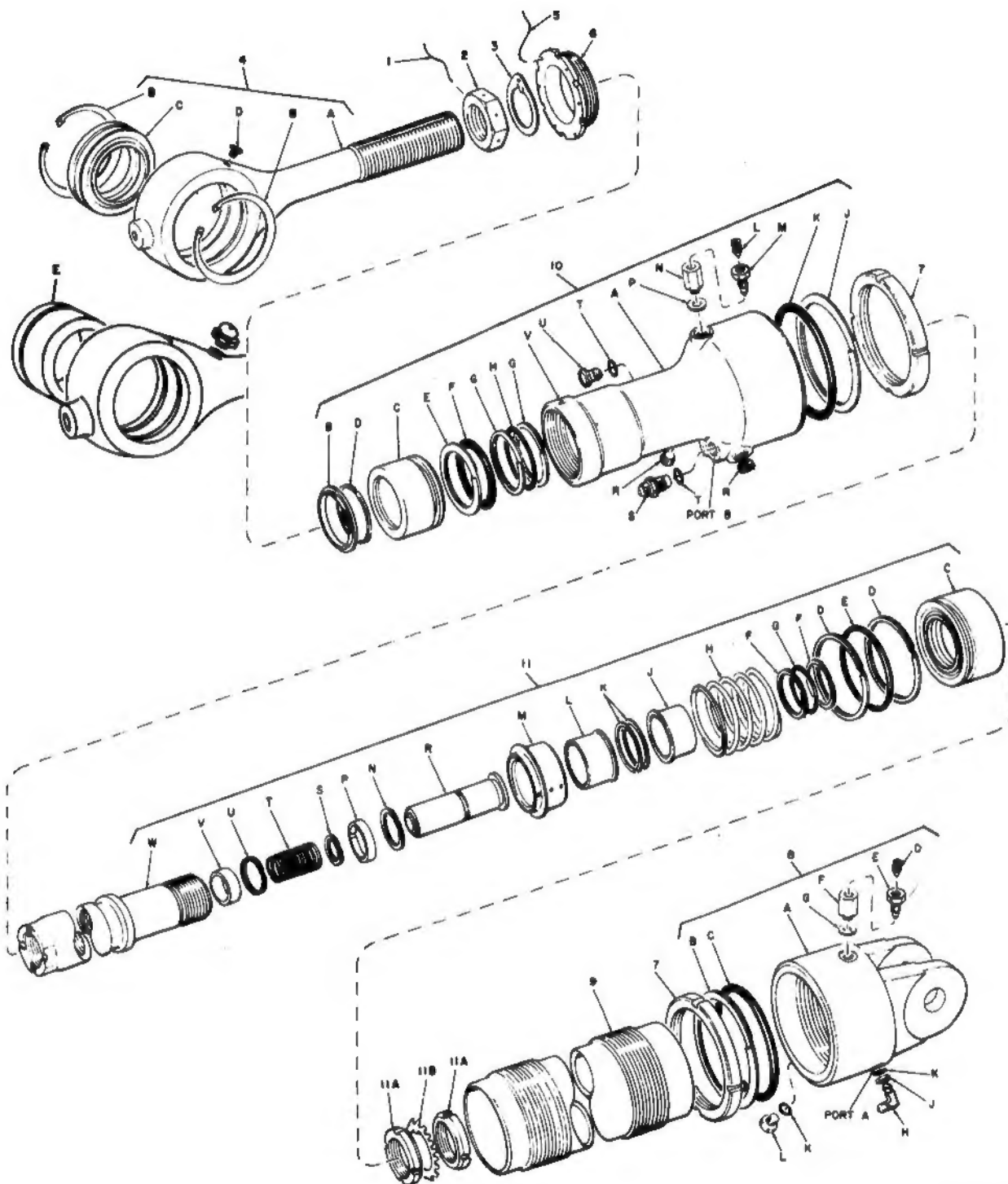
- 1-Lock wire (bulk issue)
- 2-2-12 hex. jam nut
- 3-2.016 id x 0.125 thk rod end washer
- 4-Eyebolt group
  - A-Eyebolt
  - B-4.662 od x 0.109 thk int ret. ring
  - C-Bearing
  - D- $\frac{1}{8}$ -27 UNS-2A str lub fitting
  - E-Bearing assembly 8031530
- 5-Lock wire (bulk issue)
- 6-Cylinder retainer
- 7-Stop nut
- 8-Cylinder end clevis group
  - A-End clevis
  - B-5.750 id x 0.052 thk pkg ret.
  - C-5.725 id x 0.275 thk preformed pkg
  - D- $\frac{1}{4}$ -20 x  $\frac{1}{4}$  hex. socket setscrew
  - E-Bleeder valve
  - F-Valve seat
  - G-0.351 id x 0.072 thk preformed pkg
  - H- $\frac{1}{2}$ -in. x 90° elbow
  - J- $\frac{3}{4}$ -16 hex. nut
  - K-0.644 id x 0.087 thk preformed pkg
  - L- $\frac{3}{4}$ -16 x  $\frac{1}{2}$  bleeder plug
- 9-Sleeve cylinder
- 10-Rod end cap group
  - A-Rod end cap
  - B-2.743 id x 0.109 thk piston rod scraper
  - C-Sleeve
  - D-Felt strip
  - E-3.000 id x 0.036 thk pkg retainer
  - F-2.975 id x 0.210 thk preformed pkg
  - G-2.750 id x 0.036 thk pkg retainer
  - H-2.725 id x 0.210 thk preformed pkg

- J-5.750 id x 0.052 thk pkg ret.
- K-5.725 id x 0.275 thk preformed pkg
- L- $\frac{1}{4}$ -20 x  $\frac{1}{4}$  hex. socket setscrew
- M-Bleeder valve
- N-Valve seat
- P-0.351 id x 0.072 thk preformed pkg
- R- $\frac{1}{4}$  ANPT pipe plug
- S-Check valve assy
- T-0.755 id x 0.097 thk preformed pkg
- U- $\frac{3}{4}$ -14 x  $\frac{1}{2}$  bleeder plug
- V- $\frac{1}{4}$ -in oil cup
- 11-Piston and rod group
  - A- $3\frac{3}{32}$ -18 locknut
  - B- $3\frac{1}{2}$ -in-id lk washer
  - C-Piston
  - D-4.750 id x 0.054 thk pkg ret.
  - E-4.725 id x 0.275 thk preformed pkg
  - F-2.375 id x 0.036 thk pkg ret.
  - G-2.350 id x 0.210 thk preformed pkg
  - H-Outer helical spring
  - J-Sleeve spacer
  - K-Piston ring
  - L-Packing retainer 8167080
  - M-Cylinder orifice sleeve
  - N-2.091 od x 0.049 thk int ret. ring
  - P-Cylinder bushing
  - R-Cylinder orifice
  - S-1.433 od x 0.043 thk ext ret. ring
  - T-Inner helical spring
  - U-1.937 od x 0.049 thk int ret. ring
  - V-0.873 od x 0.747 id nonmetallic bush.
  - W-Piston rod

\*These parts are installed as shown for the equilibrator cyl. assy; for the power cyl. assy, these parts are reversed.

Figure 211. Power or equilibrator cylinder assembly—disassembly and assembly—typical—legend.





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Figure 211. Power or equilibrator cylinder assembly—disassembly and assembly—typical.



- (5) Loosen the stop nuts (7) locking the rod end cap group (10) and the cylinder end clevis group (8) to the sleeve cylinder (9) and remove in the sequence indicated in (a) through (c) below.

- (a) Remove the cylinder end clevis group from the sleeve cylinder.

- (b) Remove the sleeve cylinder from the rod end cap group.

*Note.* If difficulty is experienced in removing the rod end cap group in (c) below, wrap a clean cloth firmly around piston rod (11W), sufficient to pack the opening where the piston rod projects from the rod end cap (10). Hold the cloth packing firmly to act as a buffer and apply air or oil pressure to force the sleeve (10C) from the rod end cap. Removal of the sleeve cylinder will free the rod end cap group from the piston and rod group.

- (c) Remove the rod end cap group from the piston and rod group (11).

- (6) Disassemble the rod end cap group, the cylinder end clevis group, and the piston and rod group as required.

*Note.* When removing the check valve assembly (10S) from the rod end cap group, place the hand under the assembly to prevent losing any of the spring-loaded components (fig. 212).

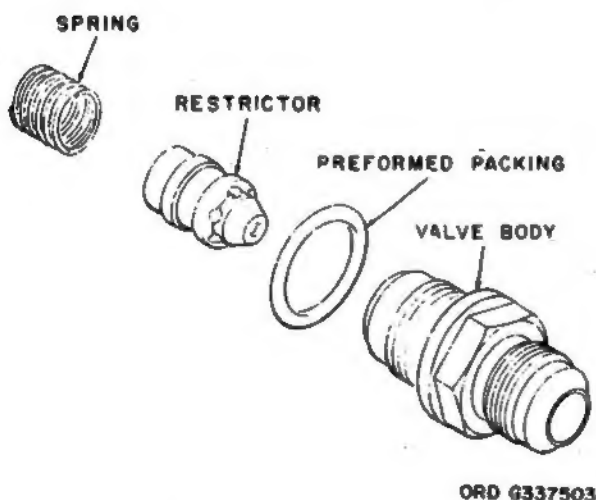


Figure 212. Check valve assembly—disassembly and assembly.

**Caution:** After completion of the cylinder disassembly, check to see that the four oil ports in the sleeve (10C, fig. 211) and the oil cup (10V) are free of any foreign matter.

#### c. Assembly.

**Caution:** All parts at time of assembly shall be free of any dust or other foreign matter detrimental to the operation of the cylinder. Precision parts shall be cleaned to remove residues of perspiration and fingerprints with a suitable remover conforming to MIL-C-15074.

**Caution:** Insure that all preformed packings are clean and free of breaks and lubricated with hydraulic fluid before installation.

*Note.* Use the holding fixture (fig. 55.3) for holding the cylinder assembly during assembly.

- (1) Install the two stop nuts (7, fig. 211), one on each threaded end of the sleeve cylinder (9); turn the stop nuts in on the sleeve cylinder as far as possible.
- (2) Assemble and install the cylinder end clevis group (8) as outlined in steps (a) through (d) below.
  - (a) Install the preformed packing and packing retainer (8C and 8B) in the end clevis (8A).

*Note.* The locations of the elbow (8H) and the bleeder plug (8L) are interchangeable depending upon whether the equilibrator cylinder assembly or the power cylinder assembly is being assembled. Refer to fig. 211 for location of these parts.

- (b) Install the preformed packings, bleeder plug, hexagon nut and elbow (8K, 8L, 8J and 8H) on the end clevis.
- (c) Install the preformed packing, valve seat, bleeder valve and hexagon socket setscrew (8G, 8F, 8E, and 8D) on the end clevis; torque the valve seat to 100 pound-inches.
- (d) Install the assembled cylinder end clevis group on either end of the sleeve cylinder; turn the end clevis down on the sleeve cylinder until it bottoms.
- (3) Assemble and install the piston and rod group (11) as outlined in steps (a) through (i) below.

- (a) Install the nonmetallic bushing (11V) in the bored end of the piston rod (11W) and secure with the retaining ring (11U).
- (b) Install the inner helical spring (11T) in the bored end of the piston rod.
- (c) Place the retaining ring (11N) and cylinder bushing (11P) on the cylinder orifice (11R), insuring that the chamfered side of the cylinder bushing faces the flanged end of the cylinder orifice; secure with the retaining ring (11S).
- (d) Slide the cylinder orifice into the bored end of the piston rod far enough to seat the cylinder bushing in the bore; secure the bushing with the retaining ring (11N).
- (e) Install the cylinder orifice sleeve, cylinder retaining ring; the two piston rings, sleeve spacer, and outer helical spring (11M, 11L, 11K, 11J, and 11H) on the flanged end of the piston rod.
- (f) Assemble the preformed packing and two packing retainers (11G and 11F) in the piston (11C); assemble the preformed packing (11E) and two packing retainers (11D) on the piston; install the piston on the piston rod.

*Note.* When performing steps (g) and (h) below, the locknuts must be installed so that their chamfered sides face each other.

- (g) Install one locknut (11A) on the piston rod and turn down firmly against the piston to make sure all components installed in steps (e) and (f) above are properly seated. Torque the locknut to  $30 \pm 10$  pound-feet.
- (h) Install the lockwasher (11B) and another locknut on the piston rod; torque the locknut to 10 pound-feet and lock with the tab of the lockwasher.
- (i) Install the piston and rod group in the cylinder sleeve.

- (4) Assemble and install the rod end cap group (10) as outlined in steps (a) through (k) below.

- (a) Install the preformed packing and packing retainer (10K and 10J) in the rod end cap (10A).
- (b) Assemble the preformed packing and packing retainer (10F and 10E) on the sleeve (10C).
- (c) Assemble the preformed packing (10H) between the two packing retainers (10G) and install in the sleeve.
- (d) Install the felt strip (10D) in the sleeve.
- (e) Install the assembled sleeve in the bore of the rod end cap.

*Note.* The location of the check valve assembly, installed in step (f) below, must be in radial alinement with the location of the elbow (8H) installed in step (2) (b) above.

- (f) Assemble the check valve assembly (10S) as shown in figure 212; install a preformed packing (10T, fig. 211) on the check valve assembly and install in the rod end cap.
- (g) Install a preformed packing and the bleeder plug (10T and 10U) in the rod end cap.
- (h) Install the two pipe plugs and oil cup (10R and 10V) in the rod end cap.
- (i) Install the preformed packing, valve seat, bleeder valve and hexagon socket setscrew (10P, 10N, 10M, and 10L) on the rod end cap group; torque the valve seat to 100 pound-inches.
- (j) Slip the assembled rod end cap group over the piston rod (11W) and turn in to the maximum bottoming position on the sleeve cylinder.
- (k) Position the piston rod scraper (10B) in the counterbored end of the cylinder retainer (6) and install both in the bore of the rod end cap. Turn the cylinder retainer in firmly but do not tighten.

- (5) Assemble and install the eyebolt group (4) as outlined in steps (a) through (e) below.

*Note.* If repair kit 5952278 has not been installed, perform (a) below.

- (a) Assemble the bearing and two retaining rings (4C and 4B) in the eyebolt (4A).

*Note.* If repair kit 5952278 has been installed, the eyebolt group was never disassembled (see step b(3) above).

- (b) Install the lubrication fitting (4D) on the eyebolt.
- (c) Install the jam nut and rod end washer (2 and 3) on the eyebolt; turn the jam nut in on the eyebolt as far as possible.
- (d) Fill the slot in the threaded end of the eyebolt with bearing grease.
- (e) Install the assembled eyebolt group in the threaded end of the piston rod (11W); turn the eyebolt into the piston rod as far as the jam nut will permit.

*d. Adjustment and test.*

- (1) Back off the rod end cap (10A, fig. 211) until the bleeder valves (10M and 8E) are alined.

*Note.* Make sure the piston is bottomed by applying 200 pounds compression on the piston rod (11W) before performing step (2) below.

- (2) Adjust the eyebolt (4A) so that the bearing hole is in a parallel plane with the mounting holes in the end clevis (8A), and to attain a retracted length of 59 inches as measured from center to center of the respective holes.
- (3) Tighten the hexagon jam nut (2) and secure to the rod end washer (3) with the lockwire (1).
- (4) Tighten the cylinder retainer (6) and secure to the rod end cap with the lockwire (5).
- (5) Using the hydraulic test stand (fig. 49), prepare the cylinder assembly for test as outlined in TM 9-4935-254-15.

**Warning:** High-pressure oil is used in the following procedures. Extreme care must be taken at all times to prevent injury to personnel and damage to equipment.

*Note.* Immediately after performing step (6) or step (7) below, bleed the cylinder assembly as outlined in the acceptance test procedures in TM 9-4935-254-15.

- (6) Apply 3000 psi to port A (fig. 211) of the cylinder assembly and torque the stop nut (7) against the end clevis to  $50 \pm 10$  pound-feet.
- (7) Apply 3000 psi to port B of the cylinder assembly and torque the stop nut (7) against the rod end cap to  $50 \pm 10$  pound-feet.
- (8) With eyebolt (4) extended, the stroke length must be  $27 \frac{1}{8} \pm 1/16$  inches.
- (9) Perform the acceptance test procedures on the cylinder assembly as outlined in TM 9-4935-254-15.
- (10) Measure and record the piston rod lengths between the face of the cylinder retainer (6, fig. 211) and the rod end washer (3) with the pistons bottomed in the fully retracted position and with the piston bottomed in the fully extended position.

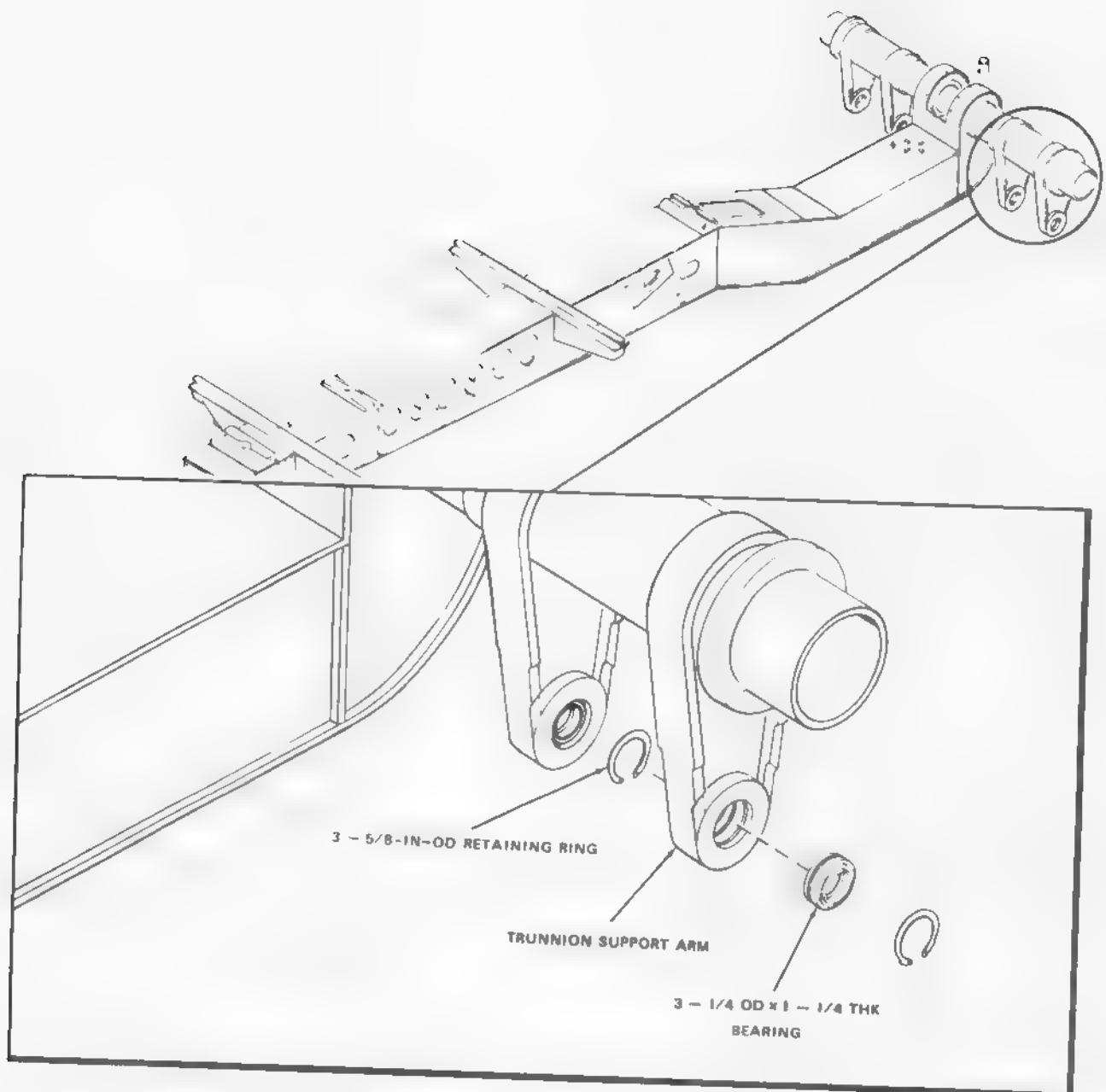
*e. Installation.*

*Note.* Install the protective cover (10, fig. 209) as soon as the rod bolt (15) is extended to its full length of travel.

- (1) Install one retaining ring (fig. 212.1) in the trunnion support arm. Install the bearing in the trunnion support arm until it is seated against the retainer ring. Install the remaining retaining ring.

*Note.* If repair kit 5952278 has not been installed, perform steps (2) through (5) below.

- (2) Install the spacer (16, fig. 209) on the trunnion pin (18) on S/N's 1021 through 3684 and 50000 through 50087.
- (3) Dip two spacer assemblies (14) into hydraulic oil and install into the eyebolt (26).
- (4) Install the eyebolt-end of the cylinder assembly (25) on the trunnion pin. Center the trunnion pin and assure that the flats are alined with the setscrews (17); tighten the setscrews.



■ Figure 212.1. Trunnion support arm — roller bearing installation.

MI339345

- (5) Install the spacer (13) and lockwasher (12) on the trunnion pin and secure with the round nut (11); torque the nut to  $285 \pm 15$  pound-inches. Lock the lockwasher.

*Note.* Torque the tension nut during repair and/or overhaul as specified; however, there is no need to periodically retorque this nut. Slight movement of the key washer within the keyed slots of the nut is permissible and will not affect the operation of the equipment.

*Note.* If repair kit 5952278 has been installed, perform assembly procedures in paragraph 971c and d.

- (6) Dip two spacer assemblies in hydraulic oil and install in the trunnion support arm (27). Connect the clevis end of the cylinder assembly to the trunnion support arm and secure with the shoulder bolt, flat washer, key washer and hexagon nut (22, 21, 20 and 19); torque the nut to  $285 \pm 15$  pound-inches. Lock the key washer.

*Note.* If repair kit 5952278 has not been installed, perform step (7) below.

- (7) Unlock the lockwasher (12) on the opposite end of the trunnion pin and torque the nut to  $285 \pm 15$  pound-inches. Lock the lockwasher.
- (8) Connect the tube assemblies (4, 5, 6 and 7) to the cylinder assembly.
- (9) Install the hose assembly bracket group (9) as outlined in paragraph 96d (1.10) and (3) through (6).
- (10) Lubricate in accordance with LO 9-1400-250-20.

*f. Piston bottoming check.* After installing the equilibrators or power cylinders on the launcher, the length of the piston rod (11W, fig. 211) should be checked with the erecting beam in the fully raised and fully lowered positions to see if any pistons are bottomed.

- (1) Measure the length of the piston rod (11W) between the face of the cylinder retainer (6) and the rod end washer (3) with the erecting beam fully raised and fully lowered, and compare these measurements with those made in 97d(9).

- (2) If measurements indicate that any piston is bottomed in either the fully raised position or the fully lowered position, follow procedures in *g* below to prevent bottoming the piston.

*g. Piston rod adjustment to prevent bottoming piston.*

*Note.* To prevent bottoming the piston in the fully raised position, decrease the length of the piston rod. To prevent bottoming the piston in the fully lowered position, increase the length of the piston rod.

- (1) Raise the erecting beam to an intermediate position and install the erecting beam support (para. 36d).
- (2) Release the pressure on the cylinders.
- (3) Loosen the hexagon jam nut (2, fig. 211).

*Note.* Viewing the cylinder from the eyebolt end, three clockwise rotations of the piston rod (11W) will increase its length by  $1/4$  inch, and three counterclockwise rotations will decrease its length by  $1/4$  inch.

- (4) Rotate the piston rod two complete turns initially in the required direction (cw to increase and ccw to decrease) and retighten the jam nut (2).

**Caution:** Remove the beam support before raising or lowering the erecting beam.

- (5) Check the piston rod length with the erecting beam fully raised and fully lowered to see if any of the pistons are still bottoming.

- (6) If additional adjustments are required, the piston rod should be rotated one complete turn in the required direction and then re-checked as in step (5) above. This procedure should be repeated until the erecting beam can be fully raised and fully lowered without bottoming the pistons.
- (7) Tighten the hexagon jam nut (2) and secure to rod end washer (3) with lock wire (1).

**97.1. Replacement of Trunnion Pin 8167827 With Pivot Rod 8031527.**

*a. Disassembly.*

- (1) Remove the secondary trunnions and launcher racks (fig. 2).
- (2) Remove the bracket group hose assembly (par. 96a).
- (3) Unlock the lockwasher (12, fig. 209). Remove and discard the round nut, lockwasher, and spacer(s) (11, 12, 13, 14, and 16).
- (4) Remove the eyebolt as prescribed in step 97b(1). Discard the retaining rings and bearings (B, C, fig. 211).
- (5) Remove and retain the lubrication fitting (4D); clean and degrease the eyebolt and lubrication fitting. Insure that eyebolt interior is free from burrs.
- (6) Remove and discard the two set-screws (17, fig. 209) to free the trunnion pin (18).
- (7) Remove the trunnion pin.
- (8) Degrease, clean, and inspect the trunnion pin bushing and setscrew hole in the strut assembly (28). Deburr, if necessary, to insure that the pivot rod (29) will fit in the trunnion pin bushing.

*b. Assembly of eyebolt group.*

- (1) Coat bearing surfaces of bearing assembly (4E, fig. 211) with grease (MIL-G-10924). Insure that surface to make contact with eyebolt interior is degreased.

- (2) Apply retaining compound (MIL-R-46082, Type 1) to eyebolt interior.
- (3) Align the lubrication hole with the hole in the bearing, and press the bearing into the eyebolt. Use a plate or similar material to insure even distribution of pressure.
- (4) Allow twenty-four hours for retaining compound to cure before operating launcher.
- (5) Replace the lubrication fitting (4D).
- (6) Install the jam nut and rod end washer (2 and 3) on the eyebolt; turn the jam nut on the eyebolt as far as possible.
- (7) Fill the slot in the threaded end of the eyebolt with bearing grease (MIL-G-10924).
- (8) Install the assembled eyebolt group in the threaded end of the piston rod (11W); turn the eyebolt into the piston rod as far as the jam nut will permit.
- (9) Insure that the stroke length with the eyebolt extended is  $27\frac{1}{8} \pm \frac{1}{16}$  inches.

*c. Assembly of pivot rod.*

- (1) Apply a thin coat of grease (MIL-G-10924) to the trunnion pin bushing and pivot rod (29, fig. 209).
- (2) Insert pivot rod in strut assembly (28); align grooves in pivot rod with setscrew holes.
- (3) Degrease setscrews (31) and setscrew holes; apply retaining compound (MIL-R-46082, Type 1) to threads of setscrews.
- (4) Turn setscrews until they bottom in the groove of the pivot rod, then back off one turn.
- (5) Allow retaining compound to cure for twenty-four hours before operating launcher.

*d. Assembly of eyebolt to pivot rod.*

- (1) For launchers having serial numbers 1021 through 3684, and 50000 through 50087, emplace spacers (30) on each side of pivot rod.
- (2) Install eyebolt (26) on pivot rod with lubrication fitting on top.
- (3) Install retainer washers (32) on ends of pivot rod (29).

- (4) Install external retaining rings (33) using retaining ring pliers.

*e. Reassembly.*

- (1) Replace the bracket group hose assembly (par. 96d).
- (2) Lubricate the eyebolt bearings and secondary trunnions in accordance with LO 9-1400-250-20.

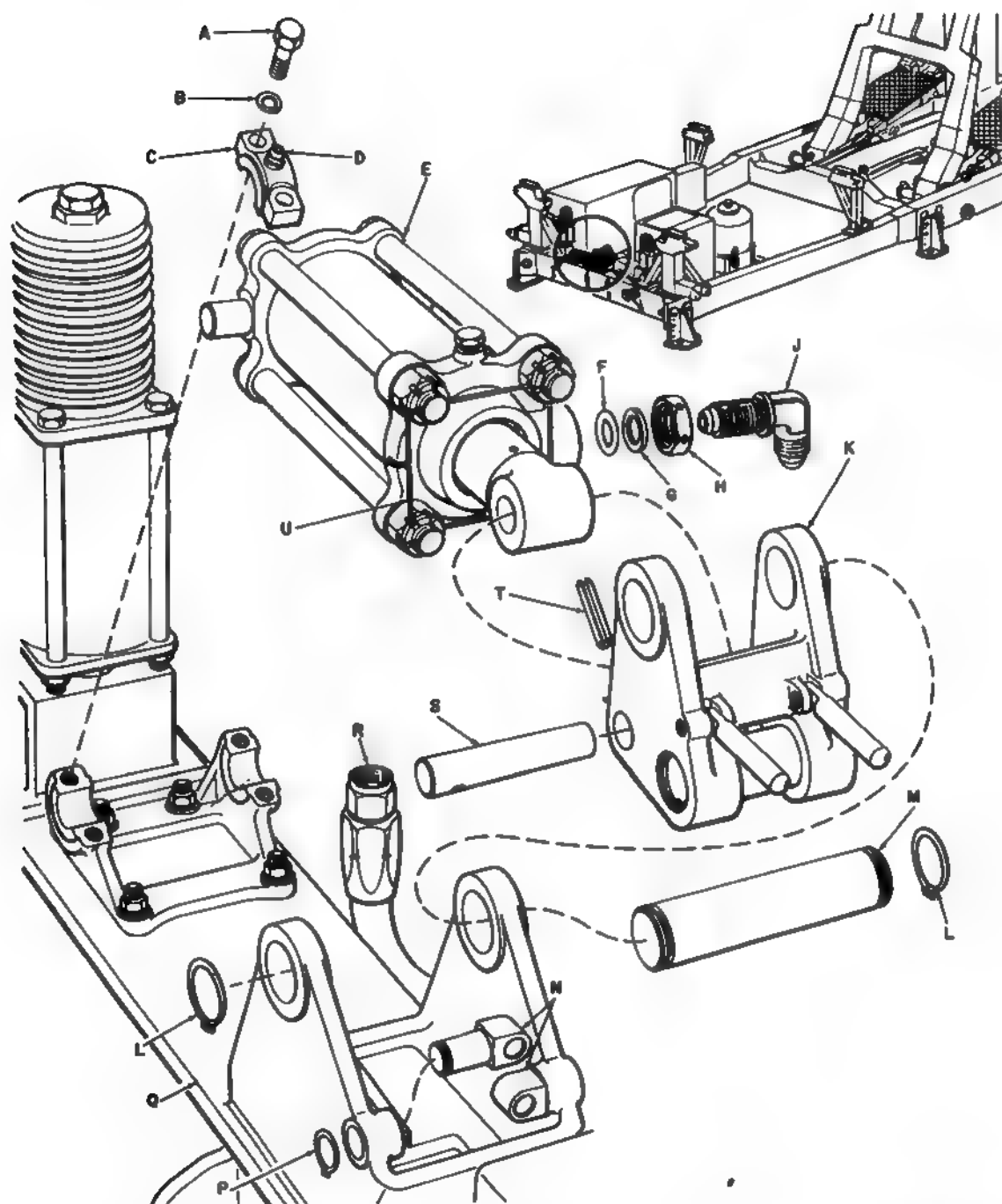
**Section VIII. MAINTENANCE OF HYDRAULIC DOWN-LOCK ASSEMBLY  
AND LATCH CLEVIS GROUP**

**98. General**

This section covers maintenance of the hydraulic down-lock assembly and the latch clevis

group. The general precautions in paragraph 58 must be observed whenever any maintenance is performed.





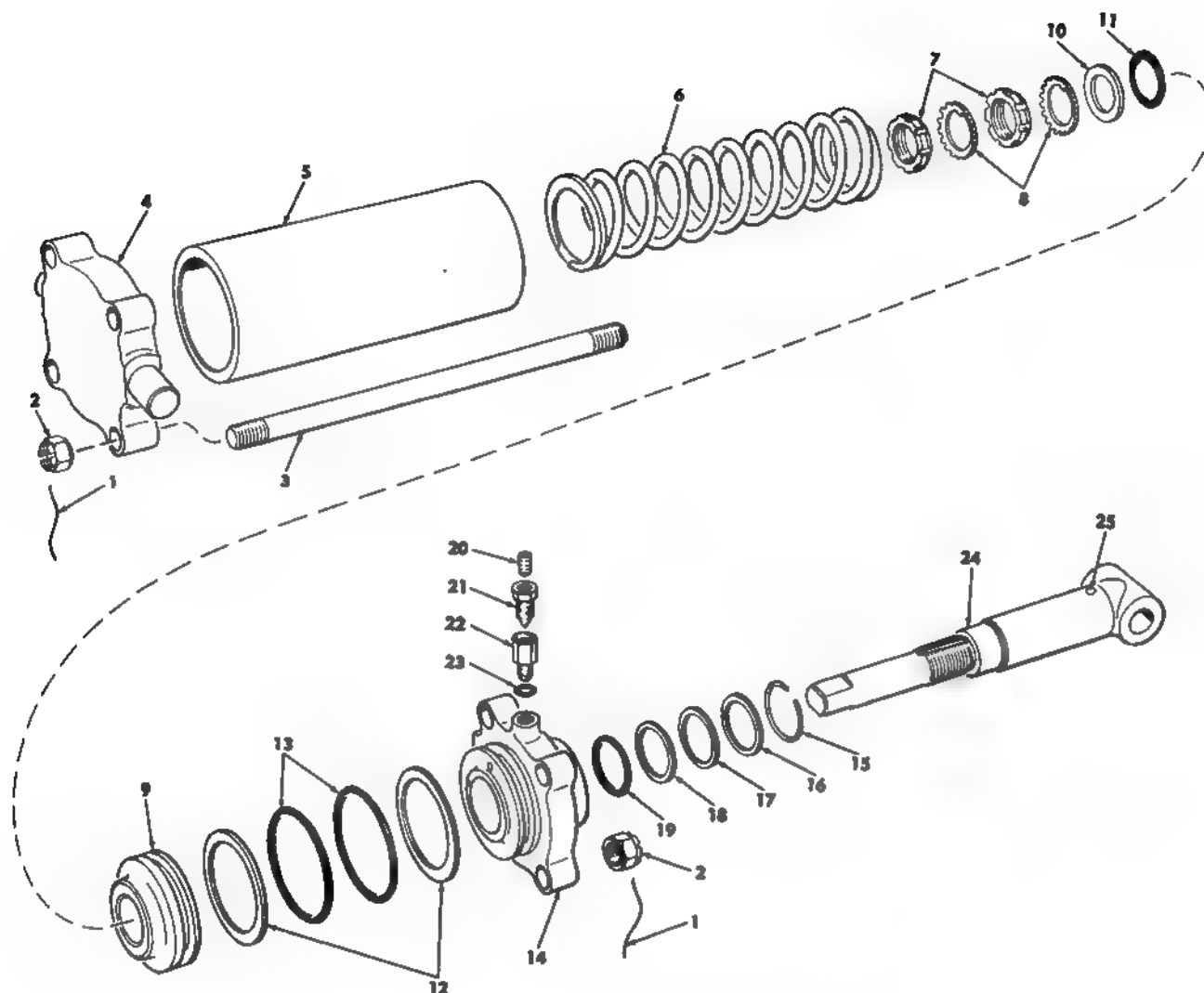
- A 3/8-24x1 HEX-HD CAP SCREW (4)  
B 3/8-IN LOCK WASHER (4)  
C PILLOW BLOCK CAP (2)  
D LUBRICATION FITTING  
E HYDRAULIC DOWN-LOCK ASSY  
F PREFORMED PACKING  
G RING

- H 3/4-16 LOCK NUT  
J ELBOW  
K LATCH CLEVIS GROUP  
L RETAINING RING (2)  
M HOLDS GROOVED PIN 8167411 (1021  
THROUGH 1252) OR 9027056 (1253  
AND SUBSEQUENT)

- N PIN TRUNNION  
P RETAINING RING (2)  
Q LAUNCHER BASE ASSY  
R RUBBER HOSE ASSY  
S CYLINDER LATCH PIN  
T 0.250x1-3/8 SPG PIN  
U 0.091-IN STEEL LOCK WIRE

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**Figure 213. Hydraulic down-lock assembly and latch clevis group – removal and installation.**



ORD G337594B

- 1—Lock wire (bulk issue)
- 2— $\frac{1}{8}$  - 20 cti hex. nut (8)
- 3—Stud (4)
- 4—Base cap
- 5—Cylinder barrel
- 6—Compression spring
- 7—1.173 - 18 lk nut
- 8—1.203-in-id ext - tooth lk wash.
- 9—Piston
- 10—1  $\frac{1}{2}$ -in-od packing ret.
- 11—1.234 id x 0.139 thk preformed pkg
- 12—3.000 od x 0.094 thk non-metallic wash.
- 13—2.600 id x 0.210 thk preformed pkg

- 14—Rod end cap
- 15—Int retaining ring
- 16—1.782-in-od wiper ring
- 17—0.125 x 0.188 x 60 felt strip (bulk issue)
- 18—1  $\frac{1}{4}$ -in-od packing ring
- 19—1.484 id x 0.139 thk preformed pkg
- 20— $\frac{1}{4}$  - 20 x  $\frac{1}{4}$  hex. soc setscrew
- 21—Bleeder valve
- 22— $\frac{1}{4}$  int x  $\frac{3}{16}$  ext adapter bush.
- 23—0.301 id x 0.064 thk preformed pkg
- 24—Connector rod
- 25— $\frac{3}{16}$  od x 1  $\frac{1}{2}$  lg spg pin

Figure 214. Hydraulic down-lock assembly—disassembly and assembly.





- (1) Raise the erecting beam to the up-and-locked position as described in TM 9-1440-250-20/1.

- (2) Remove the spring pin (T).
- (3) Remove the retaining ring (L) and the headless grooved pin (M).
- (4) Remove the cylinder latch pin (S).
- (5) Remove the latch clevis group (K).

b. *Disassembly* (fig. 215). Disassemble the clevis group.

c. *Assembly*. Assemble the clevis group.

d. *Installation*.

- (1) Connect the clevis group (K) to the hydraulic down-lock assembly by installing the cylinder latch pin (S).
- (2) Install the spring pin (T).
- (3) Install the headless grooved pin (M) and the retaining ring (L).

## Section IX.—MAINTENANCE OF HYDRAULIC UP-LOCK ASSEMBLY

### 101. General

This section covers maintenance of the hydraulic up-lock assembly. The general precautions in paragraph 58 must be observed whenever any maintenance is performed.

### 102. Hydraulic Up-Lock Assembly

Procedures for pressurizing the hydraulic up-lock assembly (12, fig. 215.1) require using an external supply of dry air or nitrogen, together with certain other parts necessary for a proper hookup. Refer to table XII.1 for a list of these parts.

Table XII.1. Parts Required for Pressurization of Hydraulic Up-Lock Assembly

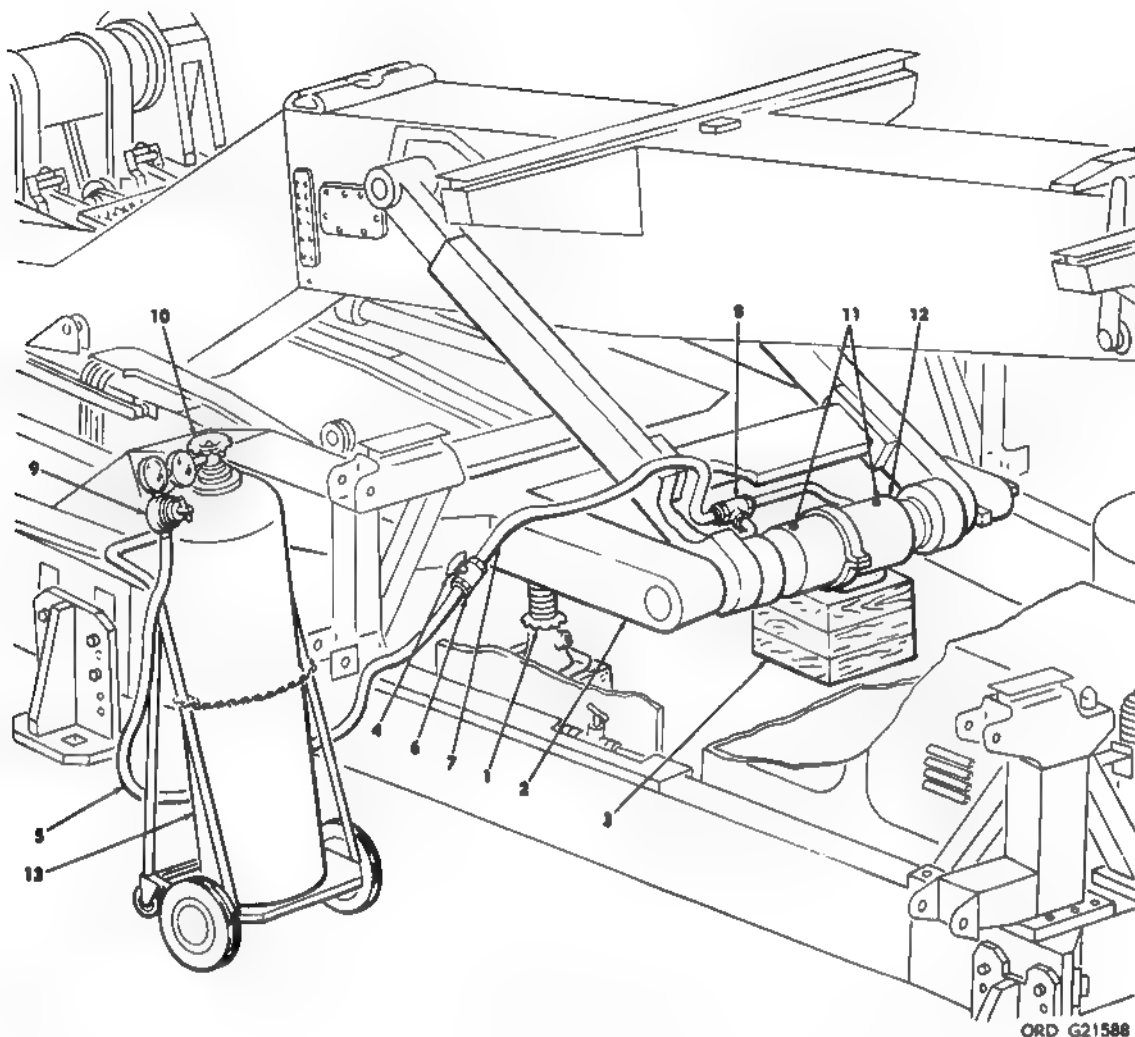
Nomenclature	Part No.	Quantity
Inlet hose .....	MS28759-8-1000	1
Inlet valve .....	8166713	1
Inlet valve nipple .....	AN816-7	1
Tube nipple .....	AN815-8	1

#### a. Removal.

- (1) Install the erecting beam support 9029892 as described in paragraph 36d.
- (2) Open the EQUILIBRATOR SYSTEM BY-PASS valve (fig. 60) and the SYSTEM BY-PASS valve.
- (3) Depressurize the hydraulic oil reservoir by turning the handle of the plug

cock to the VENT position and holding until all pressure is discharged.

- (4) Place two automotive jacks (1, fig. 215.1) capable of lifting a minimum of three tons under the launcher strut (2), using hardwood blocks (3) as required; raise jacks until they are equally snug under struts.
- (5) Remove tube assembly 8167906 (fig. 199) and cap tube ends.
- (6) Remove clamp AN742D5.
- (7) Connect the inlet valve (4, fig. 215.1) to the supply hose (5). Torque the coupling nut to 500 pound-inches.
- (8) Connect the inlet valve nipple (6) to the inlet valve. Torque the coupling nut to 500 pound-inches.
- (9) Connect the inlet hose (7) to the tube nipple (8) and to the inlet valve nipple. Torque the coupling nut to 500 pound-inches.
- (10) Remove the four hexagon-head cap screws and the lockwashers (1 and 2, fig. 216).
- (11) Remove the hexagon nut (3) and the hexagon-head cap screws (4).
- (12) Remove the four launcher strut up-lock covers (7 and 10).
- (13) Remove the four sealing rings (11) and the four split ring seals (12).
- (14) Remove the four machine keys (13).



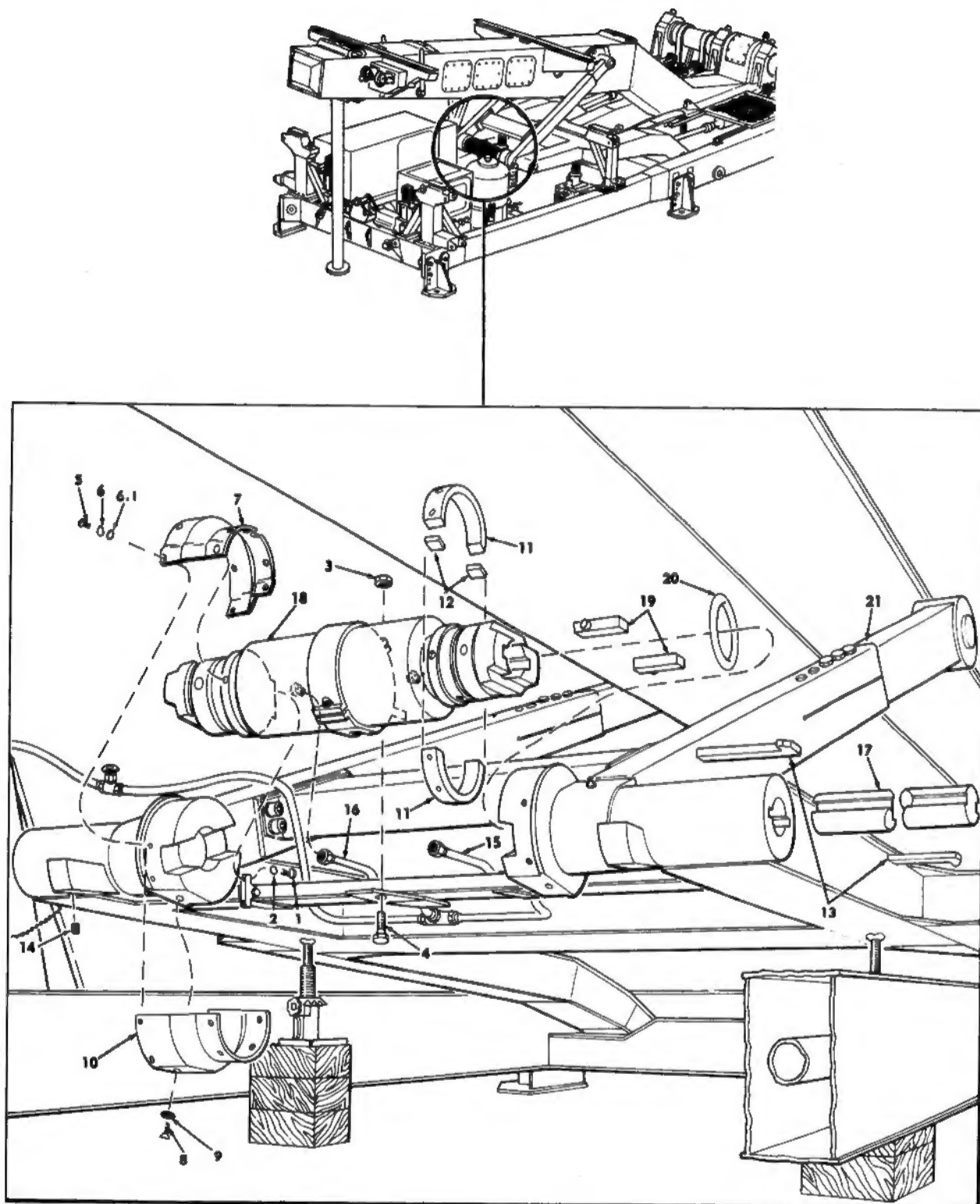
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- |                                   |                                |                                 |
|-----------------------------------|--------------------------------|---------------------------------|
| 1 — Automotive jack (2)           | 6 — Inlet valve nipple AN816-7 | 11 — Bleeder valve 8428252      |
| 2 — Launcher strut                | 7 — Inlet hose MS28759-8-1000  | 12 — Hydraulic up-lock assy     |
| 3 — Hardwood blocks (as required) | 8 — Tube nipple AN815-8        | 13 — Dry air or nitrogen supply |
| 4 — Inlet valve                   | 9 — Pressure regulator valve   |                                 |
| 5 — Supply hose                   | 10 — Supply shut-off valve     |                                 |

Figure 215.1. Hydraulic up-lock assembly — pressurization hookup.

- |   |   |
|---|---|
| 1 — $\frac{1}{4}$ -20 x $\frac{3}{4}$ hex -hd cap screw (4) | 12 — Split ring seal (4)  |
| 2 — $\frac{1}{4}$ -inch lockwasher (4)                      | 13 — Machine key (4)  |
| 3 — $\frac{5}{8}$ -11 hex. nut                              | 14 — $\frac{3}{8}$ -16 x $\frac{1}{2}$ hex -socket setscrew                           |
| 4 — $\frac{5}{8}$ -11 x 2 hex -hd cap screw                 | 15 — Tube assy 8167918  |
| 5 — No. 10-32 x $\frac{1}{8}$ rd-hd screw (28)              | 16 — Tube assy 8167917  |
| 6 — No. 10 lockwasher MS35333-73 (28)                       | 17 — Erecting beam grooved shaft  |
| 6.1 — Washer 15795-308 (28)                                 | 18 — Hydraulic up-lock assembly   |
| 7 — Launcher strut up-lock cover (2)                        | 19 — Launcher strut lock key 8167846 (4) (Part of hydraulic up-lock assembly 8167856) |
| 8 — No. 10-32 x $\frac{5}{8}$ fl-head screw (2)             | 20 — Preformed packing AN6227-47 (2)  |
| 9 — No. 10 external-teeth lockwasher (2)                    | 21 — Upper strut arm (2)  |
| 10 — Launcher strut up-lock cover (2)                       |   |
| 11 — Sealing ring (4)                                       |   |

Figure 216. Hydraulic up-lock assembly — removal and installation — legend.



ORD G540408

Figure 216. Hydraulic up-lock assembly — removal and installation.



**Caution:** Some launchers may have two setscrews installed, one locking the other in place. In those instances, both setscrews must be removed.

- (15) Remove the setscrew (14).
- (16) Close the inlet valve (4, fig. 215.1).
- (17) Open the supply shut-off valve (10).
- (18) Adjust the pressure regulator valve (9) to  $170 \pm 20$  psi.

**Warning:** Use only dry air or nitrogen supply for pressurization of the hydraulic up-lock assembly (12). Any other external supply may result in an explosion.

**Warning:** The hydraulic up-lock assembly (weight 73 pounds) must be adequately supported during the procedures outlined in steps (19) through (21) below to prevent injury to personnel or damage to equipment.

**Note.** Difficulty encountered in removal of the erecting beam grooved shaft can be alleviated by fabricating and using the tool shown in figure 55.4. Extensions in 6-, 12-, and 24-inch lengths will be required to press the shaft out of the hydraulic up-lock assembly. These extensions may be made from an old grooved shaft 8167817, by machining it to prevent binding, or trim a 2-inch diameter bar conforming to MIL-S-11415, class 1.

- (19) Remove the erecting beam grooved shaft (17, fig. 216).
- (20) Pressurize the hydraulic up-lock as-

sembly (12, fig. 215.1) by opening the inlet valve.

- (21) Lift the hydraulic up-lock assembly free of the upper strut arms (21, fig. 216).

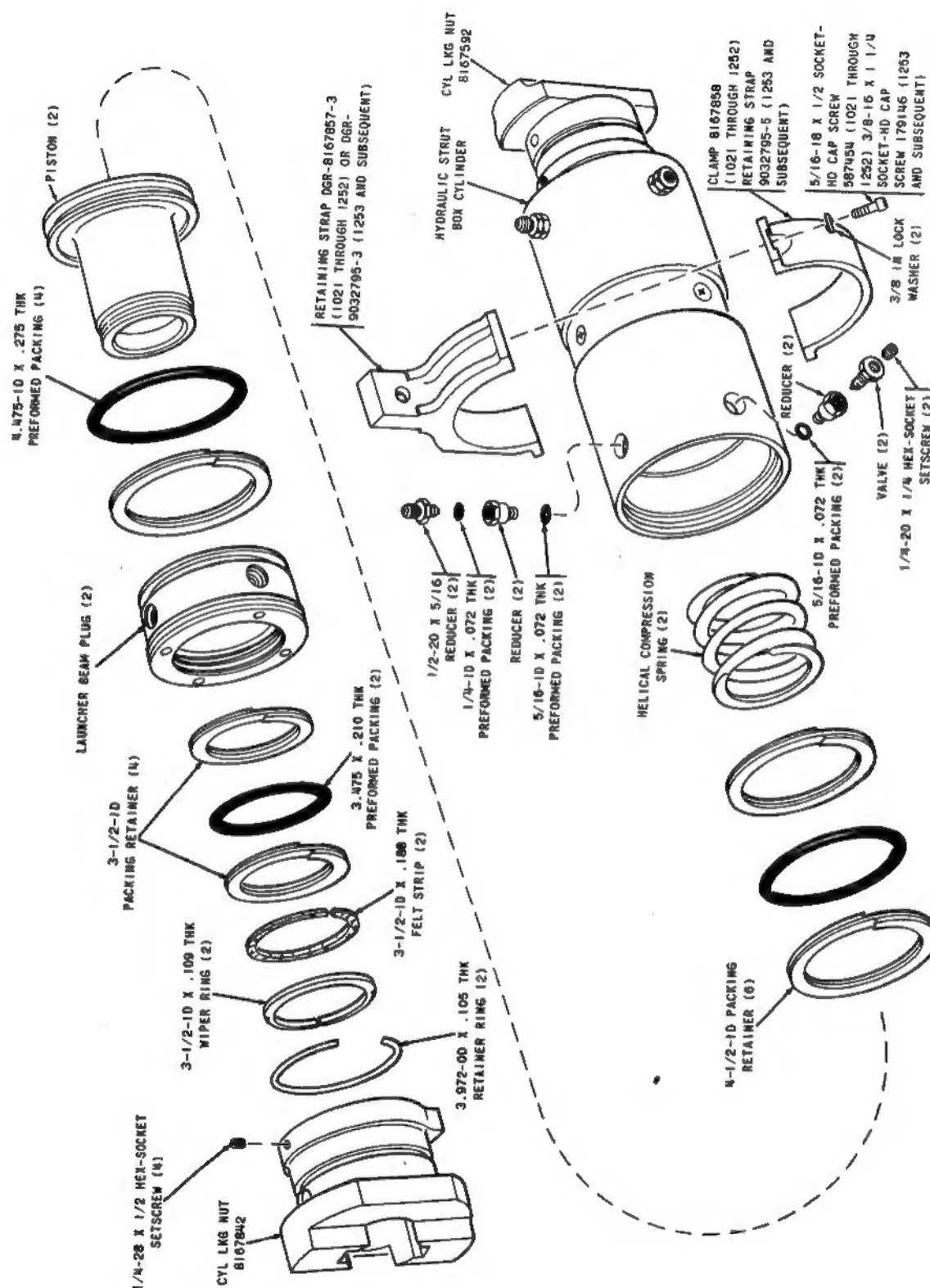
**Warning:** Keep the hands away from the ends of the hydraulic up-lock assembly when performing steps (22) and (23) below to prevent injury to personnel.

- (22) Close the supply shut-off and inlet valves (10 and 4, fig. 215.1).
- (23) Depressurize the hydraulic up-lock assembly by slowly loosening either bleeder valve (11).
- (24) Disconnect the tube assemblies (15 and 16, fig. 216) from the hydraulic up-lock assembly.
- (25) Depressurize the supply hose (5, fig. 215.1) by slowly opening the inlet valve; cap all hydraulic connections.
- (26) Remove the four launcher strut lock keys (19, fig. 216) and the two preformed packings (20).

**Note.** Typical disassembly and assembly procedures for only one side of the hydraulic up-lock assembly are outlined in *b* and *c* below.

#### *b. Disassembly.*

- (1) Remove the retaining strap (fig. 217).
- (2) Remove the two hexagon-socket setscrews and the cylinder locking nut.
- (3) Remove the tube cap, bleeder valve, reducer, and associated preformed packings, machine thread bushings and gaskets.



**Figure 217. Hydraulic up-lock assembly — partial disassembly and assembly.**

- (4) Remove the launcher beam plug.
- (5) Disassemble the remaining parts of the assembly as required for maintenance.

*c. Assembly.*

**Caution:** Nuts 8167842 and 8167592 are not interchangeable. Prior to installing the nuts, position the strut lock with the hydraulic fluid ports up and the bleed plugs toward the assembler. Install nut 8167842 on the left and nut 8167592 on the right.

- (1) Position the helical compression spring inside the piston.
- (2) Assemble the retaining ring, the wiper ring, the felt strip, and the packing retainer inside the cylinder locking nut.
- (3) Assemble the two packing retainers and the preformed packings on the outside of the piston.
- (4) Assemble the packing retainer and the preformed packing inside launcher beam plug.
- (5) Assemble the packing retainer and the preformed packing on the outside of the beam plug.
- (6) Assemble the cylinder locking nut on the piston.
- (7) Position the beam plug inside the hydraulic strut box cylinder so that holes in beam plug align with the holes in the cylinder.
- (8) Install the reducer, gaskets, machine thread bushings, new preformed packings, bleeder valve, and cap.
- (9) Install the four  $\frac{1}{4}$ -28 x  $\frac{1}{2}$  hexagon-socket setscrews.
- (10) Install the retaining strap and the clamp.

*d. Inspection and Test.* Perform a functional test of the up-lock assembly using hydraulic test stand 8523711 (fig. 49) in conjunction with instructions in TM 9-4935-254-15.

*e. Installation.*

- (1) Install the four launcher strut lock keys (19, fig. 216) and two preformed packings (20).
- (2) Connect the tube assemblies (15 and 16), and torque the coupling nuts to 200 pound-inches.
- (3) Close the inlet valve (4, fig. 215.1).
- (4) Adjust the pressure regulator valve

to  $170 \pm 20$  psi.

- (5) Open the supply shut-off valve (10).

**Warning:** Keep hands away from the ends of the up-lock assembly (18, fig. 216) when performing step (6) below to prevent injury to personnel.

- (6) Pressurize the up-lock assembly (18, fig. 216) by opening the inlet valve (4, fig. 215.1).
- (7) Position the up-lock assembly between the upper strut arms (21, fig. 216).
- (8) Install the erecting beam grooved shaft (17).
- (9) Install the four hexagon-head cap screws (1) and the lockwashers (2).
- (10) Close the inlet valve (4, fig. 215.1).
- (11) Depressurize the up-lock assembly (12) by slowly loosening either bleeder valve (11).
- (12) Disconnect the inlet hose (7) from the tube nipple (8).
- (13) Close the supply shut-off valve (10).
- (14) Depressurize the supply hose (5) by slowly opening inlet valve.
- (15) Connect tube assembly 8167906 (fig. 199), and torque the coupling nuts to 500 pound-inches.
- (16) Install clamp AN742D5.
- (17) Tighten the valves (11, fig. 215.1).
- (18) Install the four machine keys (13, fig. 216).
- (19) Install the hexagon-head cap screw (4) and the hexagon nut (3).
- (20) Position the four split ring seals (12) and the four sealing rings (11) on the up-lock assembly.
- (21) Install the four launcher strut up-lock covers (7) and (10).
- (22) Install the set-screw (14).
- (23) Close the EQUILIBRATOR SYSTEM BY-PASS valve (fig. 60) and the SYSTEM BY-PASS valve.
- (24) Pressurize the hydraulic oil reservoir to 20 psi by turning the handle of the plug cock to the AIR position.
- (25) Remove the erecting beam support 9029892 as described in paragraph 36d (2).
- (26) Perform the launcher hydraulic system air bleed procedures as described in TM 9-1440-250-20/1.